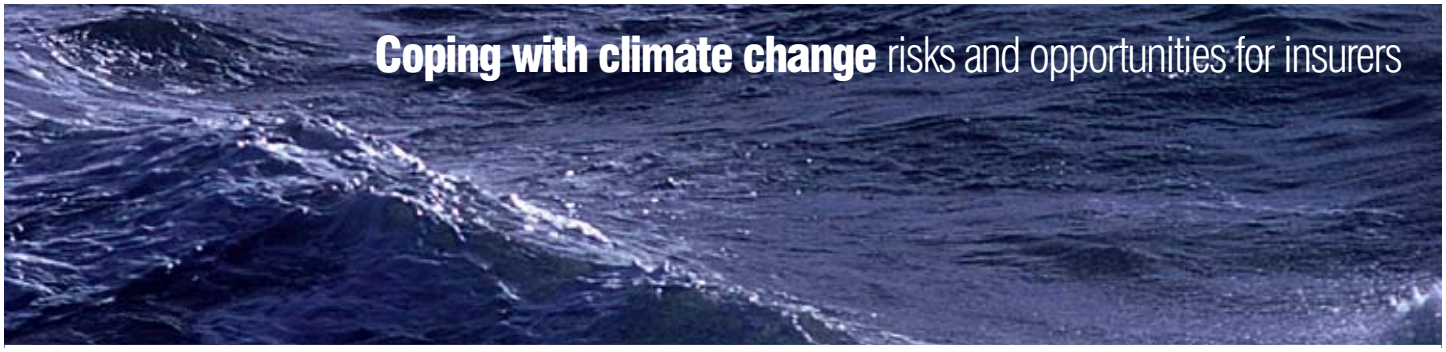


Chapter 5

Market failure and climate change

5.1 Introduction

Climate change increases the possibility of large-scale insurance market failure. While the global trend in insurance premiums is upward, and underwriters made healthy profits in 2005 and 2006, the insurance penetration is generally low in many vulnerable countries, and there are indications that weather-related problems are becoming more severe. Section 5.2 gives an overview of the ways in which the insurance market can fail to operate. The emphasis is on a comprehensive failure, rather than the failure of some individual companies. Section 5.3 considers the most prevalent reasons for major problems in insuring against climatic impacts, and how this might develop with climate change. The most obvious difficulty is the possibility of localised extreme events, but 'spill-over' effects could become important in many developed countries. Section 5.4 considers the particular issue of developing countries, where insurance markets are weak, but climatic risks are great. Currently just 20% of worldwide economic losses caused by natural catastrophes is insured, so there is a potentially large market. The next two sections consider how insurers can play a role in combatting the drift to uninsurability, firstly in mitigation, and then in adaptation. Section 5.7 presents recommendations.

5.2 Insurance market failure

An insurance market can fail to operate as desired in basically four ways; through lack of capital, lack of cover, inability to pay claims, or failure to contract.

Lack of capital

Reviews of the USA and EU insurance markets show that catastrophe losses are rarely the sole cause of a company insolvency (AM Best 1999; EU study). This is probably because almost all insurers are not monoline catastrophe operators, so they have a 'cushion' of diversified risk. Furthermore, while a few individual insurers have been driven into liquidation by weather catastrophes, there has not to date been a collective collapse of a private weather insurance market due to insolvency, or inability to service contracts. Rather, what happens is that collectively insurers withdraw cover when they consider that risks have become uninsurable. Individual insurers have become insolvent, but collectively the market has been able to service and pay outstanding claims. Additional comfort is provided by guarantee funds, which will pay out on legitimate personal line claims in a situation in which a licensed insurer becomes insolvent. Guarantee funds are funded through a levy imposed on insurers. Most operate using a funding system in which cash calls are made after an insolvency.

At an individual company level both regulators and rating agencies have in place well established methodologies with which to assess financial health. As a result of advances in computer science and forecasting, their models are increasingly sophisticated and incorporate events such as natural disasters. Static ratio tests are being increasingly replaced by dynamic financial analyses which incorporate risk based capital models.

Risk Based Capital was introduced as a threshold for insurance regulation in the United States by the National Association of Insurance Commissioners in 1995. Ten years later the FSA introduced a risk based approach to insurance regulation in 2005. The FSA approach anticipates the implementation of risk based capital supervision across Europe following the implementation of Solvency II, a new framework for prudential regulation of insurance in the EU, which dispenses with generalised financial formulas in preference for solvency requirements derived for each company from that company's proprietary risk based models, using the 'probability of ruin' concept.

Public sector weather (re)insurance markets exist in some large countries, where the tax base is relatively huge compared to the scale of natural catastrophes. There, there have been cases where the government (re)insurer has become insolvent, but it has the advantage of access to virtually unlimited public funds to recapitalise and also pay outstanding claims. (A prime case is the NFIP in USA after Hurricane Katrina, but the French government reinsurer Caisse Centrale de Réassurance also became technically insolvent after a spate of subsidence claims.)

Such arrangements are not feasible for smaller countries on their own, and may increasingly run into funding problems as climate change progresses. Developing nations have weak insurance and finance sectors and a limited understanding of underlying risk. Natural disasters can both precipitate recession and thwart economic growth. To finance disaster recovery, usually their governments seek emergency funds from the World Bank or other donors. The World Bank does not regard post disaster finance as a satisfactory solution. It takes time to organise, is expensive, unplanned and may not be available. Emergency loans also drain capital from more rewarding projects and encourage unsustainably high levels of borrowing

and imports. On the other hand, pre-disaster funding limits economic disruption speeds up disaster relief and reduces the macroeconomic problems. The World Bank is therefore actively encouraging a shift to pre-disaster funding, through insurance or similar schemes. It has initiated pilot schemes with various blends of public and private capital to introduce catastrophe insurance to developing countries, e.g. in Mongolia and the Caribbean. (UNFCCC, 2008)

Additional capital

In the light of the cost of recent catastrophic events, the industry has realised that it needs to improve its capital management. At the same time rating agencies are requiring (re)insurers to improve their security. Guy Carpenter published a review of recent changes in rating methodologies in November 2006. Both AM Best and Standard and Poor (S&P) updated their reserving requirements following Hurricane Katrina. S&P used to require capital, or reinsurance, to be in place to protect against a 1 in a 100 year storm. During 2005 and 2006 the agency phased in criteria requiring reserves, or reinsurance, to protect against a 1 in 250 year storm. The effect is such that reinsurers must maintain some 10-15% more capital to retain their old rating.

Insurers use reinsurance for additional capacity, to stabilise underwriting results and to release capital for other purposes. This makes primary cover more affordable, because a reinsurer can take advantage of the law of large numbers, because aggregating a number of different risks tends to reduce the variability around the average; a reinsurer can charge a lower loading for the inherent variability in a pool of catastrophe risks, than individual insurers would for the separate catastrophe exposures.

However, even the global catastrophe reinsurance market is subject to 'shock losses' (see below). Since covers are generally on an occurrence, twelve-month basis with limited reinstatements, this means that insurers do not actually know what their catastrophe 'hedge' costs are. Also, reinsurers do not generally specify in detail how their price would vary according to the quality of risk presented, perhaps because they fear a 'window-shopping' exercise, so insurers do not know the cost/benefit of any risk management measures they might undertake.

Other possibilities are alternative risk transfer (ART), through instruments like catastrophe bonds, more shareholder capital, or Catastrophe Reserves. Chapter 6 discusses ART in more detail, but in brief it can provide a multi-year solution for very specific risks, funded from the much greater capital markets. Other mechanisms operate in a similar way such as swaps, contingent notes and more recently 'sidecars'[1], each trying in its own way to facilitate the market response to imbalances in supply and demand. Acquiring shareholder capital may necessitate an involved and lengthy legal process, and may open the door to an unwelcome predator. Catastrophe reserves have fallen into disfavour, mainly due to a misguided application of accounting principles. US-GAAP and IFRS rules explicitly do not allow carry over of reserves for future business. They do not acknowledge that catastrophe business is really long-term risk, where events have a small probability of occurrence, but written in a short-term format. In addition, taxation authorities generally regard catastrophe reserves as corporate income in the year when they are set aside.

Shock losses

'Shock losses' are extreme, unprecedented insured events. They result in a change in the structure of the industry, and often provoke product innovation; the Tooley Street warehouse fire in London in 1861 led to the formation of the market fire tariff to share major risks and data. The 1906 San Francisco earthquake led to the expansion of Lloyds as a global reinsurance facility. Hurricane Andrew in 1992 fostered the use of catastrophe models.

Much has been learnt from the market responses to the Hurricane Andrew and Hurricane Katrina disasters. In 1995, in the aftermath of Hurricane Andrew, the Lloyd's Franchise Board established Realistic Disaster Scenarios. The franchise requires that every syndicate must not only evaluate its exposure to a series of realistic disaster scenarios but demonstrate its capital adequacy.

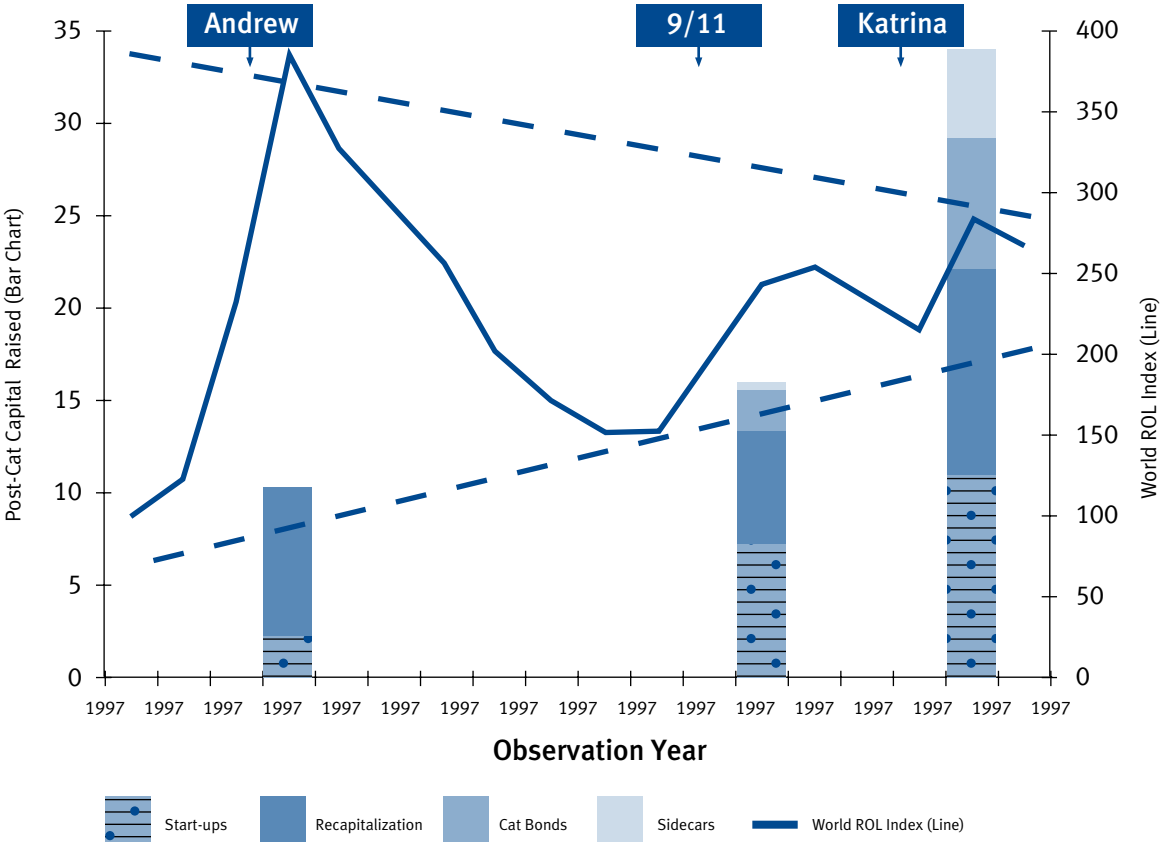
When a market experiences a shock loss, capital is removed from that market to pay claims. The robustness of the market depends upon the speed and ease with which it replaced. This is influenced by stock market conditions and by the underwriting cycle. In the cycle the price indicates the scarcity of underwriting capacity, or capital.

Reinsurance rates generally rise after a major loss; the new losses prompt a higher risk premium to compensate for uncertainty. This in turn attracts more capital as profitability prospects have improved. Historically, capacity has tended to enter the market, but not depart when profitability starts to decline.

[1] They are typically set up offshore to accept a limited range of risks on a quota share basis for an existing reinsurer. Capital is currently provided by private equity and hedge funds. Between 2005 and spring 2007 some $5 bn capital was invested in them.

Market experiences following Hurricane Andrew (1992) and Hurricane Katrina (2005) differed. In 1992 fifteen insurance insolvencies were directly attributable to hurricane related losses, and the subsequent collapse of the private windstorm market. Despite greater losses in 2005 there were no major insolvencies. However, the inflexibility of the Florida insurance regulator in not permitting rate increases led to the withdrawal of private windstorm cover from that state. This in turn led to the establishment of state-backed insurance and reinsurance mechanisms. When four major hurricanes passed over Florida in 2004 many of the losses were absorbed by the state mechanisms. However, the hurricane losses in 2005 occurred outside Florida, which prompted the need for new capital, as shown in Figure 1. Established underwriters have added capital, reinsurance sidecars lowered the barriers to entry and exit and there has been a greater involvement of products from the capital market.

Figure 1: The Changing Structure of New Insurance Capital



Source: Guy Carpenter and Corporate LLC

Lack of cover

Insurance can only work for risks that are insurable. The main principles of insurability from the insurer's side are: risks have to be quantifiable, occur randomly, and be many in number, so that variations in claims are smoothed out, and the pool of premiums has to be adequate to provide for the expected claims, other costs, and an adequate return for insurers[2]. (The buyer's viewpoint is considered in the section Failure to contract).

The quality of data on the historical and expected climatic hazards and the insured exposures is often a barrier. Poor data means the risk or uncertainty is much higher, and the private market will be less able, or unable, to participate in risk-bearing. Geographical, economic and climate data tends to be much better for developed countries than for developing countries. In general data access requires a fee, which is often at an unrealistically high level.

Moral hazard and adverse selection are common barriers to a thriving insurance market. In the former, the insured party relaxes their risk vigilance, since insurance will now pay for any losses; in the latter, parties whose risk is inherently worse than average purchase insurance, so driving up the losses beyond the insurer's expectations[3]. For these reasons, insurers usually exclude

[2] There are other conditions that need to be fulfilled, e.g. compliance with the law, but those listed are the key ones. See Sigma No 4/2005, Swiss Re

[3] Baltensperger, E., P. Buomberger, A. luppa, A. Wicki and B. Keller. Regulation and intervention in the insurance industry – fundamental issues. Zurich Financial Services, 2007.

from coverage losses due to standing crops and gradual deterioration of assets, which are key issues in terms of climatic impacts. Where climatic risk are very site-specific, such as flood, subsidence and tropical storm risks, cover may be strictly underwritten to guard against adverse selection when insurance is at the buyer's discretion.

A key strategy in avoiding these problems is that high standards of risk management for the built environment (land development, building design, construction standards, etc) are set and enforced by the regulatory authorities. In addition a balance is needed between consumer protection, and underwriting freedom. In order to compete and respond to changing circumstances, insurers need scope for differentiation (e.g. to underwrite more skilfully, design innovative products, distribute more efficiently). Overly rigid insurance regulations will deter private operators or result in a contraction of cover. Regulators must recognise that GIS for locational underwriting is particularly important for natural hazards. Also, measures like deductibles, co-insurance, and policy limits are valuable because by requiring the insured to pay some fraction of a total loss, they encourage good risk management.

For catastrophic risks the only viable alternative to private insurance is some form of government-backed system. Unsupported mutuals, captives or self-insurance arrangements could not survive an extreme event due to their limited capital base. This is at its most sophisticated in the USA, where 'residual market' mechanisms are available to accept risks that would not be insured in a free market, e.g. through state mandatory pooling arrangements called Joint Underwriting Associations (JUA) or through the state-run Fair Access to Insurance Requirement (FAIR) plans to provide windstorm cover in vulnerable coastal areas. The Federal Emergency Management Agency provides a national residual market for flood cover, funded by the taxpayer. While such arrangements may avoid immediate problems, they require a wealthy economy to support them, and in the long run they may be unsustainable. They are an inefficient use of capital, since they are notforprofit and they encourage moral hazard, due to the lack of attention to risk management policies.

Inability to pay claims

Large scale catastrophes impose stress upon the insurance system, construction industry and public services. Delays in reinstatement mean economic recovery is delayed.

This is not a remote prospect. Taken together Hurricanes Katrina, Wilma and Dennis produced 3.2 million individual claims in 2005. The 1990 winter storms in Europe produced 3 million claims just in the UK within a month. The 1999 European winter storms generated 4 million claims within a month, three-quarters from France alone. In that country, often claims were processed by small intermediaries, with no backup facilities to expand resources for an emergency.

The claims handling process could break down or become very inefficient in the face of an extreme number of claims caused by a major flood or series of windstorms. The time and cost taken to reach settlement could increase exponentially. These problems might be described as claims contagion. Once contagion has set in there are real dangers that costs will balloon, making it more likely that risks will be seen as uninsurable. This will be compounded by consumer and government discontent about the quality and speed of the reinstatement process.

Government backed insurance schemes and relief efforts are particularly exposed the issue of claims contagion. As insurer of last resort, Governments are likely to experience a surge in 'hardship' claims which are not covered in the private market. In addition, 'fast track' systems to process simpler claims open the gates to fraud by claimants and contractors.

BOX 1
Katrina

Although insurers deployed thousands of adjusters in advance of Katrina, they were denied access by the emergency compulsory evacuation, due to the failure of public services and utilities. This allowed damage to deteriorate, and complicated the attribution of damage between flood and storm. (In the USA, the private market excludes flood cover, which is available through the federal National Flood Insurance Program, NFIP). The delays increased living costs for consumers, and reduced business profits, both of which are often insured. The situation was also complicated by the escape of chemicals from industrial and domestic premises which made damage worse, and also generated liability claims. The warm climate fostered and the presence of sewage and chemicals fostered toxic mould and health hazards. Other loss-aggravating factors were public disorder (theft, looting and arson), and fraud.

The recovery process was complicated because repairs to hurricane damage in Florida in 2004 were still incomplete, and the record 2005 season included three major storms whose footprints overlapped: Katrina (direct economic damage $125 billion), Rita ($16 billion) and Wilma ($18 billion). Together they created 'demand surge', when recovery costs rocket due to labour and material constraints. Major unanticipated problems were the collapse of electronic, internet and cell phone connections, and the need for large amounts of cash, since EFT did not function. Many financial institutions found that their back-up centres were also affected by the event.

[4] Ref http://www.kilnplc.com/index.asp?k=newsarchive&a=22343

To reduce fraud and preserve a degree of impartiality, underwriters will always have to rely on adjusters to carry out their most basic promise to pay claims quickly and fairly. There are mounting concerns that the adjusting profession does not have enough manpower to deal with a major catastrophe or a series of major claims over a wide geographical area. This in turn is likely to mean a steep increase in adjusters' fees, to reflect the scarcity of resources.

- The "demographic time bomb" amongst adjusters means the profession is already stretched because of the reduction in their number as they reach retrial age, with few new starters. (CILA, 2007). In the UK in summer 2008, almost a year since a major catastrophe, utilisation for large complex cases was already running at 110%, according to Lloyd's Market Association.
- "The reliance on a travelling band of adjusters to be available for hire to deal with catastrophes". Kiln, a major player in the catastrophe market that was hit hard during Katrina relative to its size (claims totalled £77m) is apprehensive. Many of its recent seminars have found attendees agreeing with the widely held belief that while the UK adjusting profession was large enough to cope with the Carlisle flood of 2005, it needed to hire adjusters from as far afield as Scandinavia, Australia and South Africa to deal with the 2007 UK floods. The fact that most of these had also helped supplement the US profession after Katrina shows how important is the adjusting profession's task to accentuate its efforts to increase adjuster numbers.

From the standpoint of public services in the UK, the experience of the floods of 2007 and recent training exercises to deal with public emergencies, have demonstrated that procedures and resources are inadequate. Failure in that area would have major consequences in terms of increasing claims costs and workloads for insurers (see Chapter 7 for more detail).

Failure to contract

Even when cover is available, those at risk may not purchase it. Often they have low risk awareness, particularly regarding low frequency-high impact events. This may lead them to dismiss the need for insurance, or to believe that is priced too expensively. Other factors that reduce take-up are:

inefficiency – a perception that claims are settled slowly (UNEPFI, 2006);

unfairness – a belief that others will benefit unduly from the system, or that they are paying more than their "fair share" to the insurance fund;

immaterial – the cover does not apply to key risks;

alternatives – there may be other, cheaper ways of coping with catastrophes, such as subsidised or free government relief, or family networks.

Compulsory covers have been suggested as a way around some of these problems, usually in relation to property risks. They do have the advantage of avoiding adverse selection. However, they can foster moral hazard, since there may be no penalty for poorer risks, or benefit for better ones.

5.3 Trends in climatic impacts

Periodically the insurance market experiences a run of good results on weather-related perils. This always prompts the question, "Why should underwriters (and their customers) worry about climate change?" This section examines the underlying trends to show that there is in fact a real risk that climate change could create unsustainable

BOX 2
Doomsday scenario: major, multiple sequences of events

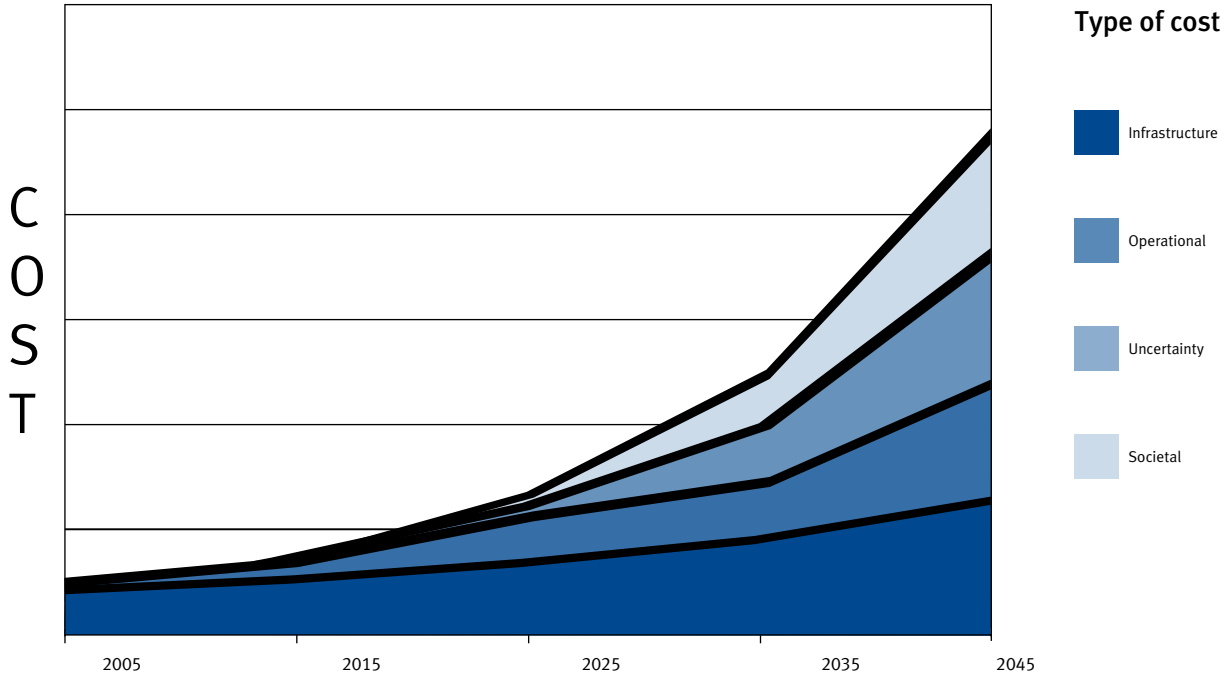
Following a period of low interest rates and no catastrophe events, insurance rates fall. New entrants seek to attract new business with broader policy terms and conditions. Underwriters begin to accept correlated property and catastrophe risks. Suddenly a spate of losses causes claims backlogs and depletes capital. Corporate and risk management structures become stressed. A second wave of catastrophes occurs before capital has been replenished, and coincides with a sharp fall in asset values due to unrelated economic factors. Claims backlogs and construction industry shortages are high, and cash to pay for claims and staff runs out as major insolvencies occur.

This scenario has been posed from time to time by kibitzers in the environmental lobby. However, the introduction of additional sources of capital to the market, and more stringent assessment of capital requirements, mean that such a double whammy is most improbable. The Realistic Disaster Scenarios at Lloyd's include multiple event scenarios. AM Best perform an additional "stress-tested" risk adjusted capital analysis for a second event.

losses in developed countries, and prevent the introduction of insurance to developing countries. The problems could arise from extreme events, such as storms or floods, or more indirectly, from changes in water, air, food quality and quantity, ecosystems, agriculture, and consumer or business behaviour brought on by climate change.

These costs will manifest themselves in a number of ways (Figure 2 is a schematic illustration). Initially damage to infrastructure (buildings, etc) predominates. Changing weather patterns and rising sea level increase the operating costs of consumers and businesses also, and these interruptions or price changes will escalate. A third factor, "opportunity cost", will emerge; the deferment of decisions due to uncertainty as the realisation grows that climate change is a material issue. There is also a fourth category, societal costs. Climate change will cause environmental damage, as well as affecting non-earning segments of the population and creating social stresses like migration, which could result in higher levels of crime. Many of these costs will affect insurers via claims. To give an idea, the Munich Re catastrophe loss data covers just "infrastructure" and part of "operational" costs, and does not include "small" incidents, which are reckoned to be as costly in aggregate as the great disasters. Yet, even then, the cost reported in 2005 came to 165 billion USD, of which half was insured.

Figure 2: Progressive onset of climate change costs



Source: Andlug Consulting loosely based on Kemfert (2005)

Extreme events

Although the IPCC's Fourth Assessment Report (IPCC,2007) indicated that there, climate change could bring surprises, the fact that all the graphical predictions show gradual trends may give the wrong impression that change will be gradual and so would be relatively manageable for insurers, especially since most non-life policies provide cover for just twelve months.

In fact experience shows that costs rise in a jerky manner, as is evident from the Munich Re chart of catastrophe losses in Chapter 2 (Figure1). The trend value for economic losses in 2005 is 50 billion USD. Industry analysts reckon that this is about half the total losses, which therefore are 100 billion USD. The data exhibits a long-term trend of 6% annual growth, which means the losses double every 12 years, taking them to 800 billion USD by 2041, in 2005 values. However, great disasters always appear in clusters. Figure 1 in Chapter 2 shows that one year in three, the costs are 50% higher than the trend-line. In fact they were more than double the trend value in 1992, 1993 and 2005. Making allowance for such clusters, and for the inclusion of societal and opportunity costs, it seems very likely that there will be a "peak" year that will record costs of over 1 trillion USD before 2040. In fact, since so much economic development is taking place in coastal zones, the figure may arrive considerably before 2040.

Costs on that scale would have an enormous effect locally and regionally, and would clearly interfere with the smooth operation of the affected insurance markets. It is possible that there may be some beneficial consequences of higher temperatures and more expensive energy, e.g. the UK may benefit from less frequent icy roads, and drivers may travel more slowly, both resulting in fewer accidents, but this will be peripheral compared to the cost of major catastrophes. Structural design may be improved to reduce damage from extreme weather, but this would be hard to incorporate into existing buildings. Therefore the negative effects will far outweigh any positive features.

Latent issues

One issue that has been "largely ignored and seriously underestimated" until recently is the security implications of climate change (Dupont and Pearman, 2008). Attitudes are changing fast in Europe, USA and Australia. The UK Government has declared that "Climate change is potentially the greatest challenge to global stability and security," (HMG, 2008). The Ministry of Defence considers that climate change is a 'ring road issues' that will touch the lives of everyone on the planet, as nations become more tightly integrated (Developments Concepts and Doctrine Centre, 2006). In Germany climate change is seen as a factor that will overwhelm many societies' adaptive capacities within the coming decades, jeopardising national and international security to a new degree. This challenge will be accompanied by a far-reaching shift in the world order, with the decline of the United States to the ascendancy of new powers such as China and India. "The lessons of history suggest that this transition will be accompanied by turbulence in the international system". (German Advisory Council on Global Change, 2007.)

There is a growing realisation that global warming will act as a 'threat multiplier' to exacerbate existing problems in weak states, and create new problems in other nations in various ways: scarcity of food, lack of water, infectious diseases, extreme events (storm and flood), culminating in migration. Most of these population flows are likely to be internal, but significant numbers will cross into other states. More worryingly, the problems could occur simultaneously in several regions. The 'magnet' regions will be North America and Europe.

The developed nations of Europe will likely be able to deal with the direct climate changes, though the less developed Balkans might be stressed. However, the major impact on Europe from climate change is likely to be migrations, first from Northern Africa and Turkey, and increasingly, from sub-Saharan Africa (CNA Corporation, 2007). Since the 1960s, Europe has experienced this kind of "south to north" migration, with an influx of immigrants from Africa and Asia. The shift in demographics has created racial and religious tensions in many European countries, as evidenced in the 2005 civil unrest in France.

Already Spain and Italy each had a million illegal immigrants from Africa by 2005, and US had 6 million from Latin America. The problem will surely grow bigger faster. Morocco, Tunisia, Libya, Turkey and Egypt are all losing productive land every year to desertification, salt water intrusion, and soil erosion. These environmental pressures are aggravated by population pressures. By 2025 the population of North Africa and the Levant will increase by 32%, whereas the EU is projected to grow 2% (Myers, 2005). The EU is now tracking this issue as a real strategic problem, involving not just nearby states, but also transit migration from failed states in other regions through Northern Africa to reach Europe (European Commission, 2008).

Developments are likely to reach a serious level over the next 20-30 years (i.e. around 2025-2040). The key challenge is to take action within the next 10–15 years, in order to avert the disruption that will otherwise intensify in subsequent decades. (Thow and de Blois, 2008; German Advisory Council on Global Change, 2007). Problems in the agricultural sector will accentuate urban drift, and put more at risk in coastal cities (Christian Aid, 2007). Urban settings are the most likely venue for social breakdown, as they are difficult to service and control. Problems that start there like black markets and smuggling will radiate outwards carrying social conflict (Global Business Network, 2007).

These societal problems have been ignored by insurers. The emphasis has been on the direct impact of extreme events. One study has examined the issue of disease and ill-health for natural systems and humans, but not in the context of an integrated model which include the full range of social problems like migration and hunger, and only in an impressionistic way (Mills and Epstein, 2005). The contention of the present study is that the direct effects on life and health insurers will not be great, since those who are wealthy enough to insure themselves privately will be less vulnerable anyway (see Chapter 15). The exception to this would be if a major pandemic was facilitated by the dispersal of environmental refugees. Political risk insurance is a specialist market, and clearly would be exposed to greater risks as climate change progresses.

The real issue for the insurance industry is that climate change could undermine their existing markets firstly by reducing

economic growth due to social disorder, secondly by encouraging moral hazard, since property-owners will neglect maintenance as incomes decline, and thirdly by increasing crime losses to unsustainable levels in many cities and towns. These problems will arise because of the spill-over effect of climate change in neighbouring regions. The additional burden of coping with migrants internally and aiding distressed countries will reduce the available public sector resources, while uncertainty and higher costs for basic necessities will erode investment for the future as well as reducing current disposable incomes. The next sections discuss how the insurance industry can act now to avoid these problems.

5.4 Adaptation

The insurance industry can play a strong part on adaptation. Different risk management measures will suit different countries, but all require a systematic, multi-stakeholder reform. Consumers need to be made risk-aware. Governments can play a major role in providing information about risks, setting and enforcing physical risk standards, and financing commercially uninsurable risks. Better regulation could stimulate the use of innovative products like cat bonds and weather derivatives, or alternative ways to fund catastrophe reserves. In developing countries, where the worst effects of climate change are expected, international aid is needed to establish viable insurance services. Insurers need to improve their own abilities to cope with climatic risks, including skills and product development.

Table 1 presents the problems that climate change poses for insurers and the strategies that the insurance industry has been using to deal with them. They are organised in a slightly unusual way, as bankers would do, to bring out the secondary source of risk; regulators, customers (market risk), and competition (business risk) with examples of each situation. That is a useful guide when drawing up strategies and action plans.

In general insurers are interested in expanding their business. Withdrawing from a market can lead to many problems, such as shareholder doubts about the longterm strategic capabilities, exit costs, and customer and intermediary distrust. Re-entry is very difficult in those circumstances. Most of the strategies in Table 1 are concerned with gaining markets, or keeping good quality business. The key decision is therefore, whether to enter a market, since the ability to reduce one's exposure is limited. For example, protections may be costly or difficult technically (as with house protections), or rate changes may be strictly controlled, as in certain US states.

Currently the insurance industry only deals with a small part of the climatic problem in terms of numbers and exposure. The amount of money that has been spent on Atlantic hurricane detection and analysis from satellites to the use of artificial intelligence belies the fact that Atlantic hurricanes constitute only about 11% of storms (GE special). As devastating as Katrina and Kyrill were, the numbers killed in Cyclone Nargis were many times greater.

This section will review the seven strategies detailed in Table 1, and then consider the implications for the reinsurance sector, and for public/private collaboration. Section 5.5 will consider the issue of entering safely into new markets for climate insurance in the developing world.

Table 1: Adaptive strategies in use by insurers

After UNEPFI,CCWG Adaptation and vulnerability to climate change: the role of the finance sector, 2006

Climate change problem	Strategy	Regulatory Risk	Market risk	Business Risk
General level of climatic risk is rising	**Reduce risk**	Engage with government on flood defence funding and land zoning (UK), and building standards (USA, Fiji)	Withdraw from high-risk areas (USA).* void catastrophic risk like flood (common) * Apply terms	Understand the sensitivity of new industries and locations (reinsurers)
Differentials in climate risk are increasing	**Price risk correctly**	Seek approval to modify prices based on risk modelling (USA)	Seasonal forecasts for hurricane risk (reinsurers) Trend allowance for climate change (rare)	Use GIS to discriminate risks (UK, USA)
Peaks in cash outflow are big	**Transfer risk**	Government back-up (France)	Reinsurance (universal)	Seek alternatives to reinsurance (brokers)
Total risk to insurers is large but uncertain	**Check aggregate**	Stress-test exposure by disaster scenarios (rating agencies, licensing authorities, common)	Internal capital-rationing, i.e. risk-based capital (common)	Consider asset-liability correlation (rare)
Losses are becoming greater and more complex	**Control loss**	Defend actions that seek to expand coverage (USA)	Contingency planning, pre-event deployment (USA)	Advanced techniques for subsidence repairs (UK)
Climatic impacts may be severe in some places	**Diversify risk base**	Open up new markets, e.g. rainfall insurance (India)	Multiline insurance portfolio (universal)	Mine data to exploit new markets (some reinsurers)
Variability is increasing	**Expand risk pool**	Observe regulatory stance on market dominance (common)	Due diligence on potential business for high risk (rare except in takeovers)	Buy portfolios from competitors (common)

* examples of market failure

Source: After UNEPFI,CCWG Adaptation and vulnerability to climate change: the role of the finance sector, 2006

Reduce risk

As noted previously, there is a real risk that in the long run climate change will make many markets uninsurable, not just due to weather conditions, but due to knock-on effects like social disorder and moral hazard. The only remedy is to prevent climate change, which is the topic of Section 6. However, even if that is achieved, many changes in risk will still occur. Where the risk is severe, and other stakeholders cannot or will not undertake measures to reduce it, then insurers will have to withdraw. However, as noted in literature produced by the ABI and III, there are many initiatives which the insurance industry has undertaken with government and other agencies to understand vulnerability, and develop ways to improve resilience to damage. Often these are achieved by better regulations, but many are voluntary, and then it behoves individual insurers to adopt these ideas as standard operating procedure.

It is common practice for insurers to apply terms, i.e. to make contractual terms more stringent by using underwriting tools like deductibles, co-insurance, and policy and inner limits. If this is taken to extremes it has the practical effect of removing cover, and will simply create moral hazard. These should incentivise policyholders to be more risk attentive. It is equally important that insurers should assist them in that task by providing risk-relevant information (see for example, the literature provided by Axa UK to SMEs on flood risk). It would also be nice to see insurers incentivising the use of risk reduction measures by improved contractual terms and financial packages to instal the risk reduction measures, but consumer awareness is still rather low to appreciate this as a real advantage. In some US states such as Florida the attitude is that "discounts are not very effective for creating incentives because of the increasing insurance premiums" (GAO, 2007). In some cases the additional cost of retro-fitting resilience measures is negligible, e.g. using treated timber in floor joists, and

can have a significant saving in future flood events. In cases where repeated flooding is expected, many measures may be economically viable, as well as preserving insurability and property value[5].

One interesting idea has been proposed in the US to overcome the cost of expensive mitigation measures[6]. Long term insurance A mortgage might include an amount for the resilience measure, and its cost effectiveness would be materially improved by a reduction in insurance premium over the life of the mortgage. One obstacle could be the extent to which underwriters want to guarantee writing catastrophe beyond a year.

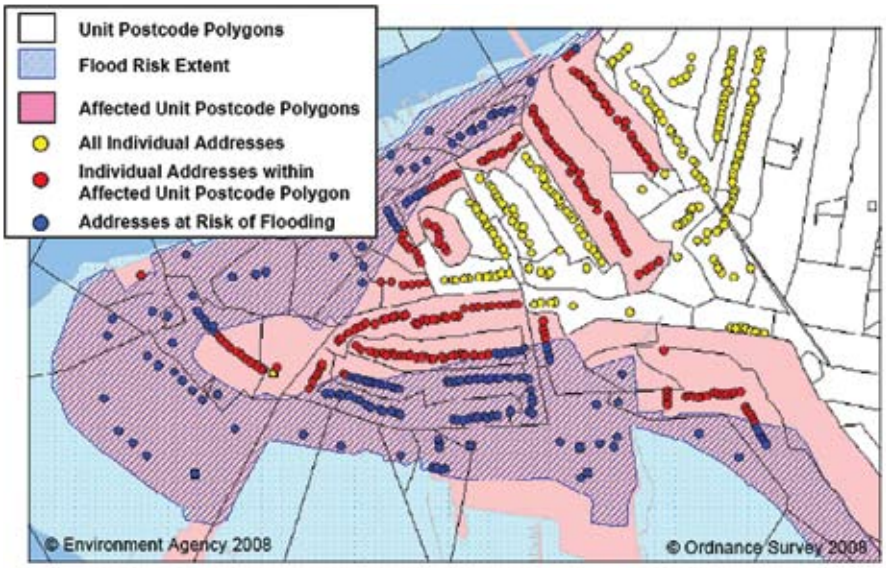
Price risk correctly

Climate change will not affect everyone evenly – in fact some locations are highly vulnerable. Subsidised markets or flat-rated insurance systems obstruct the transmission of the information required to motivate adaptation by making cover cheaper than it really should be. This has caused major problems for locational risk cover, such as flood in US and subsidence in France. Similarly, to avoid government intervention in the private market, UK insurers gave a guarantee in 1963 that flood insurance would be available on uniform, affordable terms to all British householders and small businesses. This resulted in widespread 'moral hazard', in that economic development has been lax and now millions of people are exposed to flooding in poorly defended flood plains (Crichton, 2008). In consequence, insurers have reverted to risk-based pricing for flood risks, with safeguards for existing clients.

As well as considering long-term climatic trends, it has become apparent that there are many naturally occurring patterns that affect seasonal weather (see Chapters 3 and 4). This has been used in forecasting of hurricanes and also agricultural yields, but the technique has probably got much wider applications.

Assessing risk exposure on a particular location not its post code can identify many cases that are better risks than those nearby, and which therefore justify superior terms. The UK Ordnance Survey (OS) is using its databases to show which risks in a traditionally uninsurable "wet peril" post code have characteristics that may make it insurable, e.g. are located on high ground or farthest away from a river. This is seen in Figure 3 where only the blue coloured houses are considered uninsurable while local conditions are such that red and yellow are now insurable. OS believe that in the UK this may mean that some 25% of risk may not have their flood risk inaccurately classified. While only experience will authenticate this figure in the UK and elsewhere using this concept, it is clear its use can only add to ensuring risk pools are as large as possible. Some insurers believe that the official data is too inaccurate for such fine-grained work. Chapter 7 provides a short case study of a project that Norwich Union carried out to generate location-based flood-risk data.

Figure 3: Identifying individual flood risks. Source: Ordnance Survey, 2008



[5] Flood Resilient Homes. What homeowners can do to reduce flood damage. ABI and National Flood Forum, 2003

[6] Jaffee, D., H. Kunreuther and E. Michel-Kerjan (2008) Long Term Insurance (LTI) for adressing Catastrophe Risk. Working Paper 14210. http://www.nber.org/papers/w14210 National Bureau of Economic Research, Cambridge, Massachussets

Transfer risk

Experience shows that the pattern of losses will contain large peaks. It would be inefficient for an insurer to maintain a constant high level of capital just so that it can cope with sporadic surges. The obvious solution is to transfer the peak liability to a larger pool of capital where it can be absorbed with other uncorrelated calls for cash by reinsurance or ART. Where private market reinsurers are used, insurers should review their security rigorously and regularly. Section Reinsurance considers reinsurance issues in more detail.

Check aggregates

Climate change will make the loss potential more uncertain, because it will introduce new features. Events like Katrina and the UK summer floods of 2007 are valuable, even if they are not wholly due to climate change, because they help insurers to 'think the unthinkable'. This means projections should allow for the unexpected, not just 'a bit more than normal'. For example, exaggerating factors should be examined; scenarios should examine events that are unusual in terms of location, size, strength, duration, storm surge, series of events, and contributory factors such as drainage system, flood defence, human error. The possibility of 'cat following cat' should be included, e.g. a major fire after a storm or flood reduces emergency services. While probabilistic flood risk models capturing all sources of flood risk provide the most accurate way to assess and manage EMLs and PMLs, underwriters should also seek a range of expert opinions.

These considerations should apply within a reinsurer, to individual territories and lines of business. At the enterprise level, corporate risk managers in insurance companies should check that the company is not also exposed through its investment portfolio, e.g. on real estate or cat bonds.

Loss control

Losses are becoming greater and more complex, partly due to climate change, partly due to socio-economic trends. Reinsurance does not remove the problem of large events. Firstly, the task of claim handling will fall on the primary insurer. Secondly, some costs may not be covered by the reinsurance treaty, and thirdly, the reinsurers will seek a higher premium in future if their own losses rise.

The issue of 'claims contagion' was discussed in Section 'Inability to pay claims'. It is vital that insurers have robust contingency plans to deal with peak flows of claims, including 'on-call' resources from other units, and early warning systems before events occur. Procedures to check for fraud or moral hazard (e.g. poor maintenance) need to continue at an adequate level during emergencies. Insurers and loss adjusters can work collectively with regulators and construction professionals to identify improved techniques for new-build, repair, and retro-fitting to reduce future losses.

Diversified risk base

Some markets may deteriorate seriously with climate change, to the point of uninsurability. It is, therefore, important that insurers should diversify their portfolio geographically. If care is taken to avoid the possibility of known correlations (such as with El Niño), this also has the advantage of reducing the variability of losses, and can provide a pool of resources to handle peak work flows in individual markets. Synergy with other operations can offer significant economies from existing skillsets in other countries, e.g. modelling capability, policy administration systems.

Expand the risk pool

Climate change creates increased variability at all levels, with localised events becoming more extreme, for example there is a veritable catalogue of flash-floods in the UK, hailstorms in Australia, and tornadoes in USA and UK. Many of these events would not reach the level of a reinsurance treaty, but could still be costly. By increasing a portfolio, an insurer can give some protection against this feature, since the larger volume of premium can absorb it better. Of course this increases the potential for a major loss, which underlines the need for reinsurance against larger events, and possibly an aggregation of smaller events. The alternative strategy of imposing more onerous terms will lead policyholders to question the value of cover and reduce take-up, in a vicious circle.

Reinsurance

Reinsurance is vital to the primary market's growth. It provides insurers with additional capacity to avert market failure, evens out underwriting results, lessens average and maximum losses and providing capital relief. The importance of reinsurance to climate change can be seen in its ability to expand rapidly to provide the solution to the famous question which seems almost whimsical now "How can the market deal with two $7b claims?"[7], and its significant contribution to providing cash for claims, e.g. 45 per cent of insured losses in the 2005 hurricane season[8].

A pessimist might argue that climate change means that past ability will count for little in the future. As Pielke notes[9] socio-economic trends are driving up the scale of events also, which means there is a need to limit capacity for certain risks (Swiss Re 2004), and even geographical 'offset' or diversification is becoming less effective because weather records are being broken in every continent, every year. The most dramatic examples of change in the 2005 hurricane season were not the number of hurricanes, but Hurricane Catarina in 2005 in the Southern hemisphere, and the extended track of some of the 2005 hurricanes, reaching up to Europe.

The capacity of the capital markets is such that it could be the backstop to provide capital for insurers or re-insurers to deal with super-catastrophes such as a series of climate change claims. Even in a credit crunch, cash flow is still high in some quarters (life and pensions for example), and sovereign funds and billionaires have large funds available. As Figure 1 shows, new capital can enter the market in various ways, as new starts, additional equity, ART, or 'sidecars' giving additional capacity to conventional reinsurers.

For primary insurers, the problems in using ART are considerable, due to the costly and lengthy transactional procedures and potential inconsistencies in risk assessment between the ART advisers, and reinsurers and regulators. Also, because of basis risk, accounting and regulatory rules do not allow insurers to reduce their capital requirements, whereas reinsurers operate in a more flexible regime.

A further source of reinsurance capital now appears likely – the public sector. The UNFCCC is seriously considering the possibility of using insurance as a means of assisting developing countries to adapt to climate change (UNFCCC, 2008). At the same time, the World Bank has been advocating insurance as a means of dealing with disasters, rather than disaster aid. This would help to avoid market failure, since public sector capital generally does not require such a high return because it is fulfilling social and political goals. The next section examines the issue of how public/private collaboration can improve insurability.

Public/private collaboration

Table 2 shows that to provide an effective and efficient system of insurance against climatic hazards, the public and private sectors need to work together in the planning and operational stages. Eight major issues need that collaborative process, from background issues like economic stability, efficient financial markets, and 'capacity' (i.e. institutions and trained staff in the political world, not capital as in insurance), to more direct ones like hazard knowledge, loss prevention, care for vulnerable segments, and risk transfer and loss compensation procedures.

[7] AIRAC (1986). Catastrophic Losses: How the Insurance System would handle two $7 Billion Hurricanes. All Industry Research Advisory Council (AIRAC), Oak brook, Illinois

[8] III (2006). Hurricane Season 2005 Insurance Information Institute, New York

[9] Pielke, R. J. Gratz, C. Landsea, D. Collins, M. Saunders and R. Musulin (2008) Normalized Hurricane Damages in the United States: 1900-2005. Natural Hazards Review 9 (1): 9–42

Table 2: Key aspects of public-private roles in a climate insurance system

Source: Based on Adaptation and Vulnerability to Climate Change: The Role of the Finance Sector. UNEPFI 2006.

Issue	Role of government	Role of private sector
Hazard knowledge	Basic data and research Awareness raising	Risk modeling
Loss prevention	Regulation and enforcement Physical infrastructure	Incentives in product design
Vulnerable segments	Regulation Awareness raising	Micro-insurance backed by reinsurance
Risk transfer	High risk/inaccessible sectors Guarantee fund/Volatility smoothing	Insurance where insurability exists. Services for public schemes
Loss compensation	Basic disaster aid	Claims payouts under insurance contracts. Services for public schemes
'Capacity building' *	Funding	Technical assistance
Economic stability	Security. Sound financial policy	Availability and accessibility
Financial markets	Policy and governance Access for foreign capital	Product design, distribution and marketing. Administration

*Here 'capacity' is used in the wider political sense of human resources and institutions

Source: Based on Adaptation and Vulnerability to Climate Change: The Role of the Finance Sector. UNEPFI 2006

Where the tax base is greater, the public sector may intervene, e.g. the advent of the National Flood Insurance Programme in the United States in the 1960s, the French catastrophes naturelles legislation in the 1980s, and hurricane insurance in Florida. Even such major public insurance schemes have faced technical insolvency, in France from subsidence claims, and in the US from flood claims following Hurricane Katrina.

The exact mix and design will vary from one country to another. While some countries with an established insurance market have the option of increasing risk capital through reinsurers and capital markets, this solution is not open to all. Table 3 gives a matrix of level of risk protection versus percapita income for selected countries to illustrate not only the various options open to governments but the difficulties a government faces if takes too much of a role. The US experience is considered after that, before drawing some conclusions about how to proceed in creating a more efficient market through public/private partnership.

Table 3: National variations in risk management

Percapita Income	**High**	France, UK	Japan, Holland
	Modest	Hungary, Rumania	China, Russia
	Low	Africa, SE Asia	n.a.
		Low	**High**
		Level of protections	

Low income, low protection.

It is notable how rarely events which equate to a major percentage of national GNP appear on the annual lists of insured losses.Physical protections are low even where the risk is high. Insurance solutions are impractical for many of the poorest countries save with the intervention of the World Bank and developed countries, as with the CCRIF for the East Caribbean (see Section 5.5).

Modest income, low protection

For slightly richer countries, such as Rumania and Hungary, the emphasis seems to be on reinsurance brokers helping states use GIS to investigate pools/compulsory insurance to reduce peril exposure. (World Bank, 2008)

Modest income, high protection

This variant occurs where the state has been traditionally responsible for its people in an autocratic way. A good example is at St Petersburg where it is hoped that the completion of dams in 2008 will finally reduce the city's flood risk. Insurance is not such a necessary feature when the physical protections are strong. However, economic development is creating new risks, as described in Chapter 11. One Chinese example is sufficient here. Ying Shang was a Chinese flood diversion passage area. In 1984 "Provincial Insurance" underwrote an insurance plan where the "state: policyholder" premium contribution was "70:30". The programme was cancelled after three years because no floods had occurred. No compensation was therefore available after a major flood in 1991 or since, allegedly because of the difficulties in assessing flood risk (ADB, 2007).

High protection/high income

These countries are unusual, in that they have a high degree of natural hazards, but they have succeeded in developing strong economies despite that handicap. Since property insurance is a relatively recent invention, those countries developed strong physical protections, making insurance relatively less necessary. In fact, flood insurance is prohibited in the Netherlands.

Low protection/high income.

These countries, mainly in EU, have a low risk exposure by world standards. Climate change is altering this, so that risk management is becoming more urgent. Insurance schemes include France's Cat Nat, a mandatory insurance scheme where public officials decide which events trigger payment. The disadvantage is that events that trigger compensation are open to political pressure and so may not be justifiable. The lack of risk reduction incentives is now recognised to be a major weakness which recent regulations are seeking to remedy. Some countries like Italy lack any formal scheme to manage climatic risk. In the UK, the longstanding 'agreement' to provide private market flood insurance has now ceased due to footdragging and contradictory policies by the government (see Chapter 7).

US situation

The US is in some respects a "Low Protection/ High Income" country. It is exacerbated by the fact that insurance is regulated at State level, unlike banking which is controlled centrally. In effect this means that a national insurer is transacting business in fifty countries! And usually, the insurance commissioner is highly motivated to please consumers, as the position is often an elected one. Major insurers, for their part, more and more use declinature as a 'blunt instrument' for a portfolio rather than a 'scalpel' to control the account case by case.

One way to make headway when there are strong differences in positions is for the actors to have a "wish list" but make a note of both what they need to communicate to others and their "fall back" position, i.e. points which they will find difficult to concede. However, the one thing one must have is patience[10, 11]. Table 4 suggests some simple negotiating positions which insurers might adopt, and indicates what other actors' positions might be. In this example, the shape of an agreement can be seen, with a limited public sector insurance scheme for vulnerable sectors, a strong programme of loss prevention at national and individual level, risk-related insurance premiums, and long-term reinsurance contracts.

[10] Muthoo, A. (1999) Bargaining Theory with Applications. Cambridge University Press.

[11] 'Guttman R, and P. Maes (1998) Cooperative vs. Competitive Multi-Agent Negotiation in Retail Electronic Commerce', MIT Media Laboratories. http://ecommerce.media.mit.edu

Table 4: Stakeholder negotiating positions on climate insurance

Sector	Essential Message to Other Actors	Wish list	Concedeable	Fall Back
Business and General Population	Uncertain pricing and availability are big problems	Affordable rate. Smooth annual progression in terms	Full indemnity following catastrophe	Insurance for essential needs. Share loss prevention costs.
Insurers	Insurers can be bankrupted by disasters	Flexible rating and product design	Use of declinature as a tool	No insurance without loss prevention
Reinsurers	Climate change and other trends make it hard to know PMLs	Minimum public sector capital & acceptance of terms.	Annual renewal	Terms must reflect risk over time, may be by retrospective adjustment
Government	Economic development and must not be compromised by climate change	Insurers to take more of risk for smaller business and householders after catastrophes	Total private sector solution	Public sector cover for defined vulnerable segments

5.5 Obstacles to the development of insurance in developing countries

If insurance against natural disasters were available in developing countries, that would reduce many of the problems outlined above, by providing funds to recover from disasters or a spell of abnormal weather, and underpinning credit for the purchase of climate-resilient goods like drought-tolerant crops. Currently, only 1 per cent and 3 per cent of households and businesses in low- and middle-income countries, respectively, have insurance coverage for catastrophe risks, compared with 30 per cent in high-income countries (Munich Re, 2005).

Poverty appears not to be the chief obstacle. This is confirmed in a major study of barriers to Microinsurance[12] in 38 countries. Practitioners were asked to score each of five obstacles. Lack of consumer familiarity with insurance, and lack of consumer demand were critical obstacles; taken together they outscored price, the other demand-side barrier. On the supply side the major factor was that insurers themselves feared that the products would be unprofitable (usually with no evidence or experience). The unavailability of reinsurance was not seen as a significant issue.

Table 5 displays the main problems facing the provision of insurance against climatic risks in emerging countries. These can be looked at from the supply side (the insurer, indicated in bold text in the second column), and the consumer side (demand).

Supply-side barriers

There are still major obstacles to formal financial facilities in developing countries. The primary one is the weakness of the rural financial sector. Then there are issues peculiar to insurance itself. In general, the main barriers to the private market lie in the function of risk financing (Dlugolecki and Hoekstra, 2007). Where the business is not risk-bearing, the concerns over volatility and uncertainty are greatly reduced, and the private market is more likely to participate.

One basic problem is the weak rural financial sector. Much of the rural population has no access to banking or professional financial advice. The banks themselves see the rural sector as problematic, with small accounts and high credit risk. Insurance is a second phase financial product, and is less easy to distribute because transactions are less frequent than in banking. This is the reason why microfinance has taken off, and why microinsurance is being developed; new methods are needed to reach the customers. (Satellite-based communications may assist this).

The catastrophe potential is not a critical obstacle, since in absolute scale the financial amounts concerned are usually well below the hurricane exposures which insurers accept. The real issues in dealing with extreme events are the availability of data to assess the risk, the absence of loss prevention and poor regulations. The questions of risks assessment and also loss prevention are not specific to developing countries and were discussed earlier in Section 5.4. However, it should be noted that generally developing countries lack the technical expertise and funds to carry out major risk assessment and loss prevention programmes by themselves. (Confusingly for insurers, this is called ‘lack of capacity’ in the political arena).

[12] insurance for small communities – see section 4.3

In many countries there are limitations on foreign shareholders, which may limit the scale of insurance operations and the speed of growth due to the small capital base of the domestic partners, and also on access to the global reinsurance market. If regulations are too prescriptive, they can hinder product development.

However, a second category of climate risk is more difficult to deal with, those which are 'inevitable', like desertification or sea-level rise. Often the losses are gradual, but the problem can also result in sudden catastrophic losses. These hazards are not suitable for short-term insurance. They require major risk prevention projects or relocation. At a stretch they could be handled through temporal funding like life and pensions insurance, where funds are accumulated to deal with an anticipated situation. In the case of very poor countries, the premiums could even be subsidised by richer nations, and linked to the progress of climate change, through an all-risks weather derivative (UNFCCC, 2008).

Demand side barriers

A private market requires customer demand as well as insurer supply. There are various demand-side barriers some of which the private sector may be able to overcome, while others may need public sector intervention. Generally the rural population does not know how insurance works, and this is a major barrier to market development, since they are not conveniently placed for communication. Consumer education is therefore a major prerequisite, and must be provided through trusted channels, like government or charitable agencies. This is compounded by the fact that often consumers have low risk awareness, particularly regarding low frequency-high impact events. This reluctance to buy insurance can often be overcome by tying the insurance product to a transaction like a loan.

Often there is a public disaster relief system to cater for victims (for example emergency subsistence and soft loans). This can undermine the viability of a private insurance market, so when an insurance scheme is introduced it needs to dovetail appropriately with other compensation schemes.

A further major obstacle in providing insurance for developing countries is that the sums insured are so small in individual transactions that conventional transaction costs dwarf the risk premium, and so insurance is not viable. Two major innovations have improved the possibilities of using insurance as a tool for managing the financial impacts of extreme events on individuals and small businesses. New organisations like microfinance institutions (MFI) have arisen to service the low-income sector (Grameen Bank for example), providing credit and additional services like microinsurance. Very recently, index-based insurance contracts have evolved to provide a simple alternative to traditional loss-based insurance. Section Microinsurance examines microinsurance, and Chapter 6 discusses weather index insurance.

Table 5: Main gaps and barriers to insurance coverage in developing countries: Consequences and solutions Bold text indicates supply side barriers.

Objectives/ Needs	Gaps/Barriers	Consequences	Solutions
Insurance against natural disasters and climate change	**Risk attitudes/ moral hazard**	Worsening loss trend/ insurers withdraw	Stronger risk prevention regulations
	Large events affecting whole regions/Frequent losses	Gaps in availability of insurance coverage	Reinsurance/Geographical and hazard diversification/Risk pools
	Lack of data on risks and exposure		Better quality and availability of data and projections
	Uncertainty on climate/ historical risk data irrelevant for pricing	Unexpected losses/ High prices	
	Slow-onset climate change (sea level rise, desertification)	Uninsurable risks	Risk prevention measures/temporal funding like life and pensions insurance
	Subsidised public insurance/ market price controls	Heavy losses for taxpayer/private insurance unavailable	Risk-based pricing
	Regulations hinder product innovation/foreign insurers	Lack of insurance/ slow economic growth	Less rigid government regulations
	Existence of publicly funded disaster relief	Reduced demand for insurance	Public-private partnership to segment market
	Cyclical market	Unstable prices and supply	Multi-year insurance/Risk-based pricing/ Risk-based capital
Expanding insurance coverage among the rural poor	Low risk awareness/No familiarity with insurance	Low demand for insurance	Education
	High transaction costs/ Adverse selection	Increase in cost of premiums	Micro-insurance/parametric insurance/ bundled products/supportive regulation
	Limited experience in these markets	Gaps in availability of insurance coverage	
	Weak rural financial institutions		Reinforcement of institutional structure

Source: UNEFCCC 2008

Microinsurance[13]

Without insurance, low-income segments face a poverty trap. Smallholders cannot risk investing in fixed capital or concentrating on the most profitable activities and crops, because they cannot leverage the start-up capital and they face systemic risks that could wipe out their livelihoods at any point in time. Farmers and communities have a number of coping strategies, before and after an event occurs. Some of these are efficient, (planting drought-resistant variants, avoiding single-crop reliance, diversifying income), and could be continued within an insurance setting, but others are detrimental (distress sales of assets, removal of children from education), and insurance can avoid them.

Microinsurance (MI) is a method of distributing insurance to reach low income segments, which has evolved from the practice of micro-finance (MF). It is a solution, not for environmental risk, but social and economic vulnerability. Even in OECD countries exclusion from financial services is a serious problem; in the UK, although 80 per cent of households have property insurance, this falls to under half for the poorest decile. Table 6 summarises the key differences between microinsurance and conventional insurance. The MI product range is typically very simple, the sums insured are small, typically around £25 to £100, often linked with a micro-loan, and the distributor is a key player[14].

[13] This section follows Chapter 3 in UNFCCC, 2008, which was drafted by A. Dlugolecki, with many footnotes to more detailed literature

[14] Protecting the poor. A Microinsurance compendium – see <www.microinsurancecompendium.org>

Table 6: Comparison of Microinsurance with formal insurance

	Conventional insurance	Microinsurance
Premium collection	Regular. Cash or bank account	Timing should match irregular/seasonal income. Cash, or associated with another transaction like a loan repayment or instalment.
Intermediaries	Licensed	Often informal
Contact with insurer	Common, especially for claims	Rare
Clientele in emerging markets	Wealthy/middle class and corporate	Low income, unfamiliar with insurance, so requiring consumer education
Sums insured	Medium/large	Small/tiny
Selection	May be rigorous before acceptance of risk	Limited
Pricing	Specific to each risk	Often group-based
Policy	Complex, many conditions	Simple
Claims process	Involved, losses must be proved	Simple

Source: Roth et. al., 2007

About 90 million people globally have microinsurance – mostly health and life[15]. India has had notable success, due to pro-poor insurance regulation, whereby insurers have to fulfil a quota of sales in that segment, or the related rural one. Nevertheless, global uptake is still very small in percentage terms. In principle there can be large economies of scale and risk diversification as market penetration rises.

The two main types of MI for climatic risks are 'bundled' microinsurance for MFI clients, where the insurance is linked to a loan, and 'stand-alone' products targeted specifically at weather risks. The second type ignores loss prevention, but the bundled product can link risk financing to risk reduction, if the purpose of the loan is for adaptation, e.g. to acquire drought-resistant seed.

Initially, schemes were often subsidised, with significant donor support in funding and technical assistance. However, this is changing, and premiums are often set on a commercial basis, because the rural poor will pay for a product that removes major risks reliably, e.g. common illnesses, crop loss due to pests and drought, and illness of livestock.

As indicated in Table 1 the delivery system is crucial but weak. Clients can be exposed to fraud and maladministration by insurers and intermediaries. Commercial intermediaries are disinterested due to the low commercial return, compared to the commission on conventional insurance. Regulators are now turning their attention to the question of how to support MI on issues such as minimum capital requirements, certification of intermediaries, governance of microinsurers, and product licensing. There needs to be a significant investment in 'capacity building' at many levels. Policymakers and supervisors have to understand the risks and potential of MI. Donors, international development agencies and other promoters such as (re)insurance companies, insurance associations and international microfinance networks are also learning and have to be prepared to finance and technically assist supervisors as well as microinsurers. Finally, the customers who need MI are not well educated; governments, donors and microinsurers have to assume a role in the promotion of insurance awareness and consumer education[16].

One major task now is to develop MI to indemnify losses from abnormal weather conditions, with easily accessible and affordable insurance for death, health expenses, loss of small-scale assets, livestock and crops in the event of a flood, drought, or other natural disaster. In the pilot stages, the sums insured are relatively small, so a catastrophic loss in a conventional quantum is not possible, but as market penetration rises, MI schemes need to be backed up by formal reinsurance, because natural disaster losses can affect risk pools over a region at the same time.

[15] The landscape of Mi in the world's poorest 100 countries Roth et al; Microinsurance Center, 2007

[16] Issues in regulation and supervision of Microinsurance. IAIS-CGAP Joint Working Group on Microinsurance. IAIS Basel, June 2007

BOX 3
Rainfall Insurance in India

Rainfall insurance was launched in India in 2003, through close collaboration between BASIX, an Indian micro-finance institution (MFI) based in Hyderabad, The World Bank's Commodity Risk Management Group, and private insurers and reinsurers like Swiss Re. Planning started in 2000. The weather insurance pilot was very small and the products and systems rather simple. A major expansion took place in 2005 with a simplified product and streamlined administration. Over 7,000 policies were sold, and other insurance companies and agents followed suit.

The premium rates are not low, at between 5 and 12% of sum insured, but experience shows that insurers will not participate unless the scheme is viable, and clients are willing to pay if the claim settlement process is fast and fair. In fact the initial underwriter, ICICI Lombard now sells weather insurance via BASIX, other intermediaries, and retail (direct), for crops, and also salt and brick manufacture.

This initiative has succeeded due to strong collaboration between all the partners, with doorstep delivery, quick claim settlements, and strong communication (see Figure 4). All the stakeholders gain: government by reduced relief payments and social problems, and easier budgeting; the insurer by more business; the MFI complements its client services and reduces the default rate on its loans; the poor farmers receive reliable protection for their income and assets; and overseas development agencies avoid disruption from emergency relief calls, and can claim speedier assistance for clients. Wider schemes would benefit intermediaries, by generating more revenue; and banks by protecting their credit risk.

The agents are enthusiastic about expanding further. It will help to absorb the development and overhead costs, make better use of staff time with a wider product range, and underpin rural economic development. For BASIX, the opportunity to partner with multiple insurance companies can overcome the underwriting limitations incurred by reliance on one company. From the insurer's viewpoint, the product was not profitable initially, but that was felt to be due to the policies being too narrowly concentrated geographically – a wider area would reduce the expected risk. Competition was less pronounced than for products like Motor insurance, and the rainfall product helped to fulfill official 'social' targets.

Figure 4: BASIX Insurance Business Model

Other insurance companies have copied the product. In 2005, about 250,000 small Indian farm households purchased some form of index insurance for weather risk. There are three barriers to faster roll-out. Better weather data will reduce basis risk for clients and encourage improved reinsurance rates. In fact, already the private sector is funding more weather stations. Automatic reinsurance is needed to permit greater flexibility in writing new contracts and portfolios. Third, the government should revise its subsidy policy for yield-insurance products, which undermines the weather insurance market.

5.6 Mitigation

The most important strategy to preserve insurability is to reduce GHG emissions. Insurers can play a role as underwriters and investors, through internal environmental management, and by lobbying for action on policies like 'Contraction and Convergence'. Specific strategies for underwriters to support the reduction of emissions by insuring clean energy are discussed in more detail in Chapter 12. Chapter 18 considers how the claims process can play a part in reducing GHGs by climate-friendly procurement, and also the question of embedding sustainability into every business process. The important role of asset management (investment) is examined in Chapter 16. Finally, there is the question of what role insurers should play in formulating policy about climate change. Many leading scientists are now very concerned that climate change could lead to irreversible dangerous changes in the Earth's climate system, through such processes as rapid melting of the icecaps, a shutdown of the Gulf Stream, extensive dieback of tropical forests, and acidification of the oceans (see Chapter 3 for more detail).

Despite the gravity of the threats, the will to act is weak. There are powerful lobbies ranged against mitigation[17]. Politicians fear to act, because making energy dearer, or constraining consumerism are potentially vote-losing. Insurers themselves have been reluctant to become involved, while the chain of accountability in asset management is confused and priorities are short-term[18].

[17] Leggett,J. 1999 The Carbon War. Allen Lane, London

[18] Dlugolecki A.and M.Mansley, 2005. Asset management and climate change. Technical Report No 20 Tyndall Centre for Climate Change Research, Norwich

In the face of scientific uncertainty and political antagonism, American insurers have been very reluctant to commit themselves[19] (see Box 4), though recently both AIG and Allianz, through its USA subsidiaries[20], have declared that global warming is a problem that needs urgent attention. Swiss Re and CERES have also attempted to mobilize US insurers with reports on the likely hazards. The U.S. National Association of Insurance Commissioners has placed the issue on its agenda, but is reluctant to approve rate rises based on expectation not experience.

There are some collective initiatives on climate change in the financial sector that include insurers as supporters or members. Four significant ones are the Carbon Disclosure Project (CDP), United Nations Environment Programme Finance Initiative (UNEP FI), Climatewise, and the Munich Climate Insurance Initiative (MCII). There is one loose global insurance strategic initiative for insurers, the Geneva Association.

CDP is an international NGO, based in London. Its purpose is to improve disclosure of corporate exposure to climate change to institutional investors, through an annual questionnaire to listed companies (3,000 in 2008). It has now finished six reporting cycles, and on 1 February 2008, it stood at 385 institutional investors, many of them leading insurers and pension funds, with assets of $57 trillion under management. CDP does not lobby for policy change, but with a high response rate of 77%, the data that it collects shows the importance of policy. The majority of the respondents cited regulation as a key risk factor. Regulatory uncertainty has delayed many companies' strategic investment decisions. However, when positive regulations are enacted, companies say they are a catalyst for climate-friendly investment in new products and services, and attention to carbon credits.

UNEP FI is a global partnership between the United Nations Environment Programme (UNEP) and individual financial institutions. Currently there are 170 signatories to the UNEP FI Statements of Principle, including 31 regional and global insurers. Its goal is to develop and promote linkages between the environment, sustainability and financial performance. The focal point on global warming is the Climate Change Working Group (CCWG), which has produced a stream of excellent papers on climate change since 2002 from the financial perspective, and are frequently used as reference documents. However, if one considers active membership, and engagement with policymakers, then the situation is not so impressive. The CCWG has 16 members, of which five are global insurers. And when UNEP FI issued its "Declaration on Climate Change by the Financial Services Sector" at the time of the 2007 G8 Meeting, only 23 members signed, of which only four were insurers. UNEPFI rarely meets negotiators or officials of UNFCCC at the various formal venues on international climate change policy, so in practice it has little real influence. In its most recent report on mitigation[21], CCWG stated that the most immediate business issue is to ensure continuity in the regime beyond 2012, with clear, reliable targets for emission levels up to 2025 at least, supported by consistent policies. However, the paper did not propose any level, nor how it should be shared between countries. In its companion briefing on adaptation[22], CCWG suggested that the annual cost of extreme weather events might exceed one trillion USD (in 2006 values) at least once before 2040. The paper proposed more systematic planning for such events, by mainstreaming climate change into all significant policies and operations in various ways. Again, no proposal was made concerning a prudent atmospheric concentration of emissions.

BOX 4
Insurance company SEC filings and climate change

Friends of the Earth reviewed the 2004 Securities and Exchange Commission (SEC) filings of 106 publicly traded property/casualty insurers in the USA. Three mentioned climate change as a risk factor: Allianz, Aspen, and Millea (Tokyo Marine). Chubb and Cincinnatti FC said they continue to "explore and analyze credible scientific data" (the wording was identical).

Aspen stated, "climate change may increase the frequency of severe weather events". Coupled with increases in values and concentrations, "a single catastrophic event could affect multiple geographic zones, or the frequency or severity of catastrophic events could exceed our estimates" with an adverse affect on financial performance.

[19] FotE, 2005 Fourth Survey of Climate Change Disclosure in SEC Filings of Automobile, Insurance, Oil & Gas, Petrochemical, and Utilities Companies

[20] Allianz, 2006 Climate Change and Insurance: An Agenda for Action in the United States

[21] UNEPFI, 2007 Carbon Crunch: Meeting the Cost. UNEPFI, Geneva

[22] UNEPFI, 2006 Adaptation and Vulnerability to Climate Change: The Role of the Finance Sector. UNEPFI, Geneva

Climatewise

A third initiative, Climatewise, started in 2007 to foster best practice on climate change-related issues among insurers, and was invited to make a statement to policymakers at COP14. The 42 insurance groups called for binding medium and long-term emissions-reduction targets, and action on three key areas in a new global framework: all countries to implement national adaptation plans; a long-term international arrangement for collecting and sharing climate risk data; and a review of synergies between adaptation and mitigation measures.

Munich Climate Insurance Initiative (MCII)

Munich Re has set up a collaboration with research institutes, which is called the Munich Climate Insurance Initiative (MCII). It presented proposals to COP14 for a two-pillar international risk-management programme as part of an adaptation regime for developing countries – financed fully by Annex 1 countries. A risk prevention pillar would directly support risk-reduction measures. A two-tiered insurance pillar would address high- and medium-layers of risk.

The Geneva Association (TGA)

The International Association for the Study of Insurance Economics, also known by its short name The Geneva Association, is an organisation formed by a maximum of 80 Chief Executive Officers of major insurance companies around the world. Its main goal is to research and debate strategic issues where insurance or risk and uncertainty play a substantial role, or which influence the insurance sector. To date TGA has made no formal statement about climate change, though it has published numerous papers and fostered debate, and is said to be preparing a position Paper for COP15.

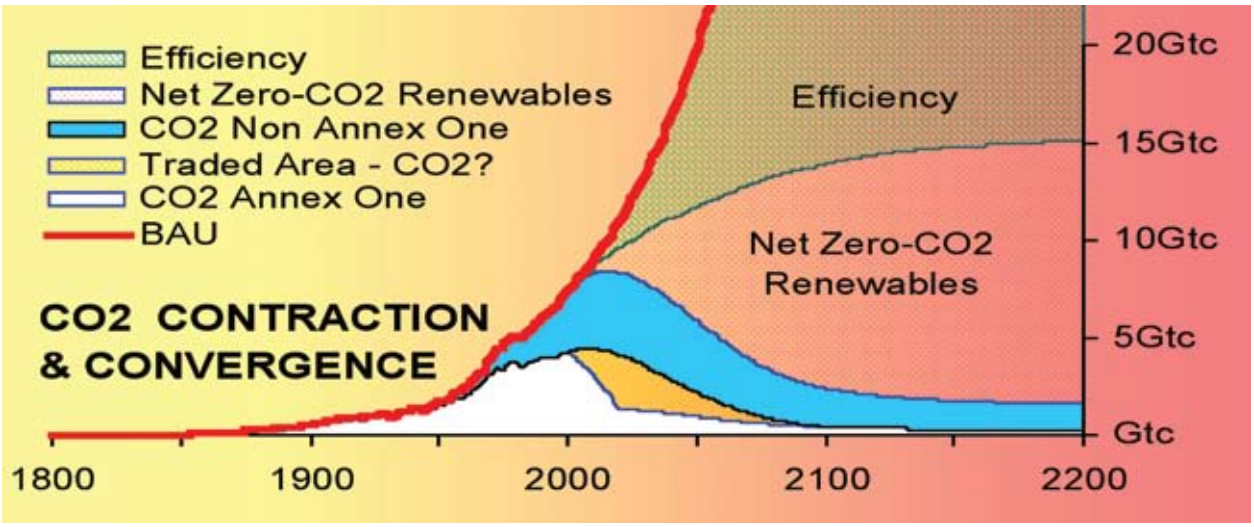
So far, these five bodies have not made a substantial impact on international climate change policy, since policy development is unpredictable and requires frequent attention, whereas they either ignore policy entirely, or give it only spasmodic attention. This 'vacuum' is dangerous, because it fosters delay. Insurers have a unique capacity to speak out in this area. On the one hand, they are experts in assessing physical risks and managing their consequences. On the other hand, they are long-term custodians of trillions of dollars on behalf of clients and beneficiaries – assets at risk to global warming. The tactics of negotiating near-term targets can be left to the political process. What is needed is a long-term, "safe" goal for emissions with an allocation method that is easily understood and will guide near-term policies and actions.

Contraction and convergence

From a risk management perspective, the costs of being too lax about emissions could be very high, due to a breakdown in the climate system. It therefore makes sense to aim for tough limits, which can be relaxed later if appropriate. There is ample guidance from scientific sources on this[23]. Many scientists believe that an atmospheric level of 450 ppmv (parts per million by volume) of carbon dioxide should be the initial target for prudence; already we are at 380. For long-term allocation, the "Contraction and Convergence" model (C&C) seems appropriate (see Figure 5). This consists in choosing (1) a "safe" global annual emissions level and (2) a date at which it will be shared out globally on a percapita basis at national level. The other element is (3) a start date from which time the actual, unequal percapita emissions that currently exist at national level start to move towards their final, equal percapita levels. The name C&C reflects the facts that the annual emissions contract to a safe level, and the percapita shares converge to become equal.

[23] IPCC, 2007Fourth Assessment Report, Working Group I

Figure 5: Contraction and Convergence (C&C)



Key: Vertical axis is billions of tonnes of carbon emitted annually.
Horizontal axis is the year.

Source: Global Commons Institute

The solid line 'BAU' or Business as Usual shows the path that emissions will follow on historical patterns.

The 'CO_2' segments of the chart show how actual emissions could develop under C&C. The gap between BAU and actual emissions would be solved by energy efficiency and RE. In the short run, since the C&C emissions allocation is based on equal per capita allowances, that gives the developing world a surplus of emissions credits to trade, as they have lower per capita emissions generally.

This elegant policy has been recommended to policymakers by numerous bodies, including the Church of England, the World Council of Churches, the Royal Commission on Environmental Pollution, and the German Scientific Advisory Committee to Government (WBGU), and was commended by UNEPFI in 2002. It has the advantages of simplicity and fairness, gives long-term confidence in emissions reduction, and in the short-term can accommodate a variety of 'fixes' as well as facilitating the flow of funds to developjng countries.

5.7 Conclusions and recommendations

Climate change increases the possibility of insurance market failure, particularly from events outside Europe. The most obvious risks are from extreme weather – analysis suggests that global warming may be compounding catastrophe losses by two per cent per year. Social disorder and international tensions could also deteriorate to the point where substantial markets become uninsurable. Insurance markets can fail through lack of cover, lack of capital, or inability to pay claims. Lack of cover (uninsurability) is the most likely of these three problems to spread with climate change, since it is already occurs because many climatic risks are not attractive to underwriters or the premiums or claim-handling are unsatisfactory to the consumer. Lack of capital (insolvency) is generally associated with under-pricing, but risk assessment techniques have improved greatly, and few insolvencies arise from catastrophe exposure in isolation. Inability to pay claims (claims contagion) is when the administrative and damage recovery systems cannot cope with the sheer volume of work. This is a real possibility as organisations have slimmed down, and systems are more vulnerable to disruption.

The most important strategy to preserve insurability is to reduce GHG emissions. Insurers can play a role as underwriters and investors for clean technology, and by lobbying for action on policies like Contraction and Convergence. The insurance industry can play a strong part on adaptation. Different risk management measures will suit different countries, but all

require a systematic, multi-stakeholder reform. Consumers need to be made risk-aware. Governments can play a major role in providing information about risks, setting and enforcing physical risk standards, and financing commercially uninsurable risks. Better regulation could stimulate the use of innovative products like cat bonds and weather derivatives, or alternative ways to fund catastrophe reserves. In developing countries, where the worst effects of climate change are expected, international aid is needed to establish viable insurance services. Insurers need to improve their own abilities to cope with climatic risks, including skills and product development.

Recommendations

The framework involving information, education and innovation must be developed to enable the insurance industry to meet the challenge of natural hazard and climate change.

Professionals

On underwriting issues, be more creative when risks look uninsurable. In discussion with the client it may be possible to identify viable alternatives to simply pricing the risk out of the market.

On claims issues, look for opportunities to incorporate risk improvement. At the same time, be alert for moral hazard.

Companies

Ensure that knowledge of climatic hazards and risk-relevant trends is current, and takes account of the range of valid expert opinion, and translate this information into product- and process-relevant terms. For example flood risk should be on the basis of location-specific GIS.

Seek to develop products that incorporate loss prevention such as demountable flood defences or water-resistant materials.

Provide hazard-relevant information to at-risk clients to help them to manage their risks better.

Support government initiatives to introduce climate-related insurance in developing countries and for vulnerable segments of the UK population.

Carry out ‘worst-case’ evaluations of claims-handling contingency plans and reinsurance programmes, with independent advisors as a reality check.

Review the company’s exposure to loss from climatic hazards, by territory and line of business, and develop realistic plans to reduce the risk in as positive a way as possible, but if necessary by exiting.

Reinsurers should continue to be flexible in sourcing capital in order to provide sufficient capacity for the growing need for climate insurance. Endeavour to provide longer-term risk transfer solutions so that clients and consumers have more stability.

Market Bodies

Professional bodies should increase the attention given to climate change in their education and continuous professional development framework, in terms of the science, impacts and solutions.

Trade bodies should ensure their members are well-informed on the problems and opportunities concerning insurability and climate change, lobby government to ensure that risk management is a core principle of government policy, and work with government and other agencies to develop sustainable solutions to climate change, including loss prevention regulations and insurable energy technologies. They should consider sponsoring the development of an independent index of market robustness, which would indicate the aggregate degree of coverage, the collective vulnerability to catastrophes, and the overall capacity to manage a disaster claims situation.

Public sector (within the UK)

The government should consult insurers regularly on risk management of climatic hazards within the UK to ensure that insurability remains at a high level. More urgency should be given to a programme that will make insurance accessible to vulnerable segments of society, e.g. by providing insurance with rent to residents in social housing.

Access to public information, particularly meteorological data, that is relevant for assessing exposure to climatic losses should be made freely available to all stakeholders, including insurers.

There is big potential to use insurance in the form of Microinsurance and indexed risk transfer products so that developing countries can adapt more effectively to climate change. The UK has many skills and relationships that could help to develop insurance systems for the varying needs of developing countries, most of which currently have very weak insurance markets, and are very vulnerable to climate change. The government should provide funding for the initial stages of such exercises, which involve considerable technical work such as hazard assessment as well as consumer education before a viable insurance system can become established. This would fit within the UK's international commitments to assist such countries as development aid and adaptation finance, and at the same time give the UK further new markets.

Given the potential for major disruption to the economy from climatic stresses elsewhere, the government should set more demanding targets for UK emissions, reduction by 2020. UK should propose the 'Contraction and Convergence' framework as a suitable model for developing a set of national targets for every country, capable of garnering support from developed and developing nations.

At-risk parties

Take responsibility for understanding your climatic risks and managing them without relying entirely on insurance. Negotiate favourable insurance terms for making risk improvements.

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Biography

Martin Dockrill

Martin presently works for the Due Diligence Team at Jardine Lloyd Thompson in London where he helps financial institutions assess their risk exposures on large construction projects. His insurance career was first developed as a sub branch and main branch underwriter for liability accounts at the then UK's largest composite insurer. He left to take an MBA at Manchester Business School where his thesis concerned the underwriting of risk using artificial intelligence. On leaving, he was instrumental in setting a development agency in the North West that invested in local businesses before ultimately moving to Aon in London. While there, his responsibilities included being a manager in their Major Accounts and Projects units.

As well as many 'standard' types of insurance, Martin has a strong grounding in more esoteric fields of insurance for larger corporations, e.g. catastrophe cover, mortality, EIL and business operations.

He is a Senior Examiner for the Chartered Insurance institute ("CII") and has served on several of their panels and committees as well as those of the British Insurance Brokers Association. In the UK, he has not only authored several insurance related articles and contributed to various textbooks but he is currently responsible for writing various chapters in a CII Advanced Study Group on "The underwriting of risk in the 21st century". Elsewhere, he contributed a paper to President Clinton's Y2K Committee in 1999 and his recent work on pandemics was highlighted in a number of projects by authorities in the United States, Canada and South Africa.

Nick Ford MSc, FCII

Nick studied Maths and Physics at Liverpool and Exeter Universities in the early 1980s then worked for some years in the aerospace industry. He joined PriceWaterhouseCoopers in 1994 and developed a small research team which looked at reinsurance security and the problems of market failure. In 2006 he completed a Certificate in Natural Hazards for Insurers at the Aon Benfield Hazard Research Centre. Nick completed the Fellowship programme in 2007 and worked as a postal tutor for the CII. He is currently working as an independent consultant.

Biography

Dr Andrew Dlugolecki

Andrew spent his salaried career with General Accident (now part of Aviva Group), starting in 1973 as a statistical analyst. Early projects included the effect of weather on motor and property claims. There followed a variety of interesting jobs at senior level, including managing the UK branches, and then emerging countries. A merger in 2000 led to a change in corporate direction, and departure for him.

When scientists started to investigate the economic implications of climate change in 1988, they asked various industry associations to identify experts to work with them. The British Insurance Association nominated Andrew, and he continued this "sideline" even as he worked in other areas, and then as a second career after he left Aviva.

Andrew's work on climate change covers three major aspects. Firstly, advice to politicians: he has been the chief author on insurance and financial services in major studies of climate change commissioned by the UK government, the EU, and of course the Intergovernmental Panel on Climate Change.

Secondly, in education, he has chaired three major studies of climate change by the UK Chartered Insurance Institute (1994, 2001 and 2009). He prepared and mentored modules of an e-learning training package on climate change and finance for financial institution executives, under the auspices of UNEP Finance Initiative (UNEPFI). He often gives talks and writes articles.

Thirdly, he continues to be active with business clients. He has been an advisor to the Carbon Disclosure Project and the UNEP Finance Initiative since 2000.

Andrew's qualifications include degrees in pure and applied mathematics, and a doctorate in applied economics. Among his affiliations he is a Fellow of Chartered Insurance Institute, and a visiting Fellow at Norwich University's Climate Research Unit. When IPCC received the Nobel Peace Prize in 2007, Andrew was one of those cited who had "contributed substantially" to their work.